J. New York Entomol. Soc. 94(4):542–551, 1986

THE PLANT BUGS (HEMIPTERA: MIRIDAE) ASSOCIATED WITH *ADENOSTOMA* (ROSACEAE) IN SOUTHERN CALIFORNIA

JOHN D. PINTO AND ROBERT K. VELTEN

Department of Entomology, University of California,
Riverside, California 92521

Abstract.—The Miridae associated with chaparral shrubs in the genus *Adenostoma* were collected throughout 1983 at two sites in southern California. Six species were taken from *Adenostoma fasciculatum* H. & A., and two from *A. sparsifolium* Torr. Although both shrubs commonly occur together their mirid associates overlap minimally. Only the widespread *Rhinacloa forticornis* Reuter occurs on both.

This is the second in a series of studies of the Miridae associated with major chaparral shrubs of southern California. An earlier paper examined the associates of *Ceanothus crassifolius* Torr. (Pinto, 1982). This study considers the mirids of the two closely related species of *Adenostoma, A. fasciculatum* H. & A., commonly known as chamise, and *A. sparsifolium* Torr., or red shank.

Adenostoma fasciculatum is the dominant component of chamise chaparral, the most common form of chaparral in California. This shrub forms extensive stands especially on hot, dry, south and west facing slopes and ridges from Trinity and Shasta counties in northern California south to northern Baja California (Hanes, 1977). *Adenostoma sparsifolium* is more restricted, with a patchy distribution from southern San Luis Obispo County in California south to near El Rosario in Baja California Norte. Almost 90% of the sites with *A. sparsifolium* are coinhabited by *A. fasciculatum* (Marion, 1943).

Although the two *Adenostoma* species are considered closely related, their growth and flowering periods are distinct. *Adenostoma fasciculatum* is active primarily in winter and early spring; *A. sparsifolium* is active from spring to autumn. Hanes (1965) presented an ecological study of the two shrubs.

This study was based on collections of all instars of Miridae on *Adenostoma* spp. at two sites in southern California throughout 1983. At one site only *A. fasciculatum* occurred; at the second, both species occurred together.

Objectives of the study were to determine the species of Miridae occurring on the two shrubs, their relative abundance, their occurrence relative to host phenology, the degree of interspecific seasonal overlap, and the degree of faunal overlap. A determination of faunal overlap was of particular interest considering the close relationship and extensive sympatry, but phenological dissimilarity of the two hosts.

SITE DESCRIPTIONS AND METHODS

The two sites utilized were as follows:

Site I. 33°39′N, 117°13′W; 550 m elev. Only *Adenostoma fasciculatum* occurs. This locale is in the low, dry hills to the immediate west of Menifee Valley, an ill-defined area near the southern terminus of the San Jacinto Plains in SW Riverside

County. The vegetation is dominated by chaparral but has a distinct Coastal Sage Scrub influence. This site was described more fully in a previous paper (Pinto, 1982).

Collections of Miridae at Site I were confined to an area of ca. 600 m^2 on a west facing slope of moderate gradient. *Adenostoma fasciculatum* forms an almost continuous cover on this slope except for scattered individuals of *Salvia mellifera* Greene (Labiatae), *Eriogonum fasciculatum* Benth. (Polygonaceae), and *Ceanothus crassifolius* Torr. (Rhamnaceae). The opposite, east facing slope is dominated by *Salvia mellifera, S. apiana* Jeps., and *Eriogonum fasciculatum.*

Site II. 33°42'N, 116°46'W; 1,150 m elev; ca. 45 km E of Site I. Coinhabited by *Adenostoma fasciculatum* and *A. sparsifolium,* the dominant perennials at this site. Occurring on a west facing slope at the SW end of the San Jacinto Mts adjacent to State Hwy 74, ca. 2 mi W of Mountain Center, this site is more mesic than Site I and the chaparral vegetation is considerably more dense and diverse.

Samples of Miridae were taken in a relatively restricted area of ca. 1,000 m^2 where the two *Adenostoma* intermixed and occurred in about equal frequency. To the immediate east (upslope), *A. fasciculatum* dominated; to the west (downslope) *A. sparsifolium* dominated. *Arctostaphylos glauca* Lindl. (Ericaceae) is widely scattered throughout the area. Other less common perennials include *Cercocarpus betuloides* Nutt. ex T. & G., *Prunus ilicifolia* (Nutt.) Walp. (Rosaceae), *Ceanothus cuneatus* (Hook.) Nutt., *Ceanothus leucodermis* Greene (Rhamnaceae), *Quercus dumosa* Nutt. (Fagaceae), *Eriodictyon crassifolium* Benth. (Hydrophyllaceae), *Lonicera involucrata* (Richards) Banks (Caprifoliaceae), and *Garrya veatchii* Kell. (Garryaceae).

Ten mature shrubs of *A. fasciculatum* were sampled at Site I from 1 January to 15 December 1983. Except for an hiatus of two weeks in late summer, collections were taken approximately once a week with a mean of 7.4 da (range, 4–11) between samples. Ten shrubs each of *A. fasciculatum* and *A. sparsifolium* were sampled at Site II from 6 January to 12 December 1983. Collections were taken approximately once every two weeks with a mean of 12.2 da (range, 5–17) between samples. Several additional collections were made at two week intervals at Site I in 1985 from February–May. Early 1985 was much drier and warmer than the equivalent period of 1983, and the purpose of these collections was to compare seasonal distribution and abundance of one of the vernal species.

Collecting procedures closely followed those used in the study of *Ceanothus* Miridae (Pinto, 1982). Collections were made by beating hosts and allowing specimens to fall into a modified sweep net, 12 cm deep and 28 cm in diameter. Three positions at 1–1.5 m height were sampled on each shrub. Care was taken to sample plants that were not contacting other species. Specimens were quickly aspirated at each position and killed in cyanide after all plants were sampled. Most of the immatures were transferred to 70% alcohol. Adults were either point mounted or also placed in alcohol. All sampling was done between 1000–1400 hr.

Larvae and adults were easily associated by traits common to both. Rearings verified these associations.

Precipitation and average temperatures relative to mirid seasonal distribution are given for Site I (Fig. 7). Rainfall was recorded on site; temperatures were taken from U.S. Climatological Data for Sun City, CA, ca. 3.5 km from the collecting area.

Voucher specimens from this work are located in the collections of the Department

1

2

3

4

Figs. 1–4. Males of three species of Miridae occurring on *Adenostoma fasciculatum.* 1. *Microphylidea* sp. or near (dark form). 2. *Microphylidea* sp. or near (light form). 3. *Orthotylus fraternus.* 4. *Parthenicus picicollis.* Body length for specimens in Figures 1–4: 2.7, 3.5, 3.0, and 4.2 mm, respectively.

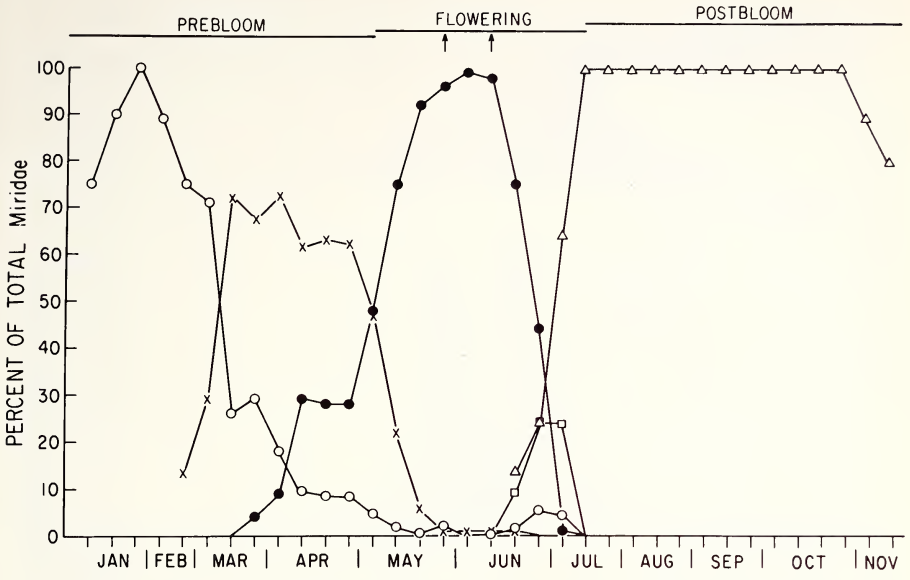

Fig. 5. Phenology of Miridae and *Adenostoma fasciculatum* at Site I (Menifee Valley, CA) during 1983. Adults and immatures combined for each species. ○ = *Phytocoris vau*; × = *Orthotylus fraternus*; ● = *Microphylidea* sp. or near; □ = *Rhinacloa forticornis*; △ = *Parthenicus picicollis*. *Phytocoris californicus* not included but considered in calculating percentages. Arrows at top delimit period of maximum flowering of *A. fasciculatum*.

of Entomology, University of California, Riverside, and the National Museum of Natural History, Washington, D.C.

RESULTS

Adenostoma fasciculatum Associates

Six species of Miridae were found to develop on *A. fasciculatum*. These include two Mirinae, *Phytocoris californicus* Knight and *Phytocoris vau* Van Duzee; two Orthotylinae, *Orthotylus fraternus* (Fig. 3) Van Duzee, and *Parthenicus picicollis* Van Duzee (Fig. 4); and two Phylinae, *Microphylidea* sp. or near (Figs. 1, 2), and *Rhinacloa forticornis* Reuter.

Phytocoris californicus was uncommon. It was represented only by four larvae collected in winter and three adults taken in summer of 1983. It was found only at Site I and is not considered further.

The identification of *Microphylidea* sp. is tentative. Also, distinct light and dark forms of this species are grouped under this identification (Figs. 1, 2); only adults were distinguished (Fig. 6). Additional work is needed to determine if they represent distinct species.

Rhinacloa forticornis is a common species with numerous recorded plant associations (e.g., Knight, 1968). The other species (except *P. californicus*) are known only

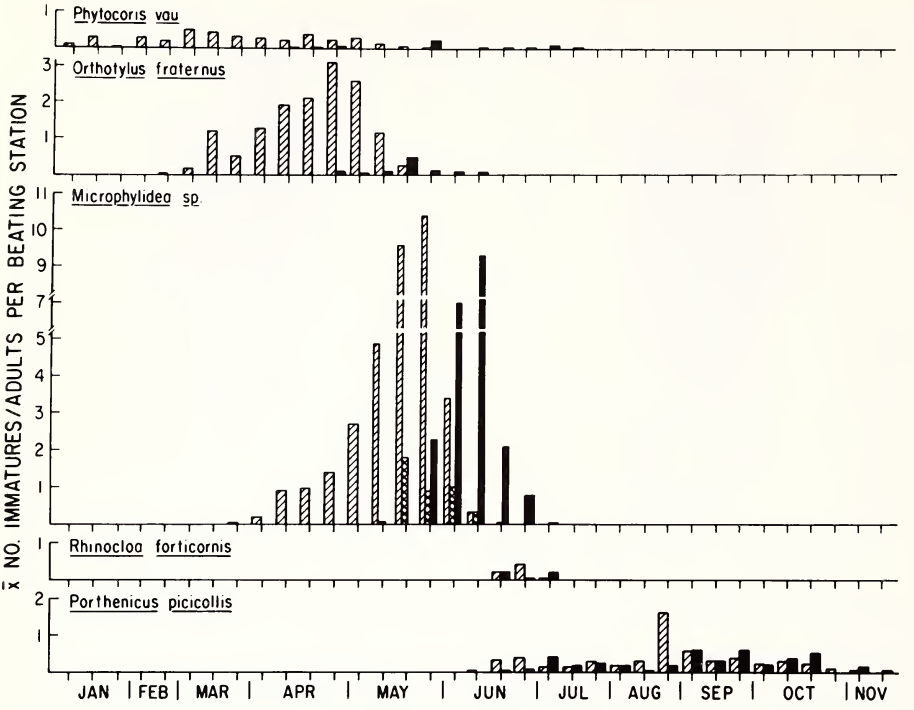

Fig. 6. Phenology and relative abundance of Miridae at Site I (Menifee Valley, CA) on *Adenostoma fasciculatum* during 1983. Bars with diagonal markings = immatures; solid bars = adults; for *Microphylidea* sp. bars with cross hatching = dark form adults, solid bars = light form adults. x̄ No. per beating station calculated by dividing total catch by 30 (10 plants, 3 stations per plant).

from chamise. *Parthenicus picicollis* and *Phytocoris vau* were previously recorded from this host (Van Duzee, 1916; Knight, 1968); the occurrence of *Orthotylus fraternus* and *Microphylidea* sp. on chamise are new records.

Sampling results for Site I are presented in Figures 5 and 6. Figure 5 gives the percentage of all stages of each species on *A. fasciculatum* relative to total number of Miridae per sampling day. Figure 6 considers the relative abundance of adults and larvae of each species. The mean number of individuals per beating station (total catch divided by 30) is given for each sampling day.

Mirids were collected from *A. fasciculatum* at Site I during all months of 1983 except December. No adults or mature larvae were collected until late spring, indicating that all species overwinter in the egg stage.

Each species except *Rhinacloa forticornis* was dominant at some time of the year (Fig. 5). However, only *Orthotylus fraternus* and *Microphylidea* sp. were abundant (Fig. 6). Both occurred immediately before and during flowering and closely followed the time of maximum rainfall (Figs. 5, 7).

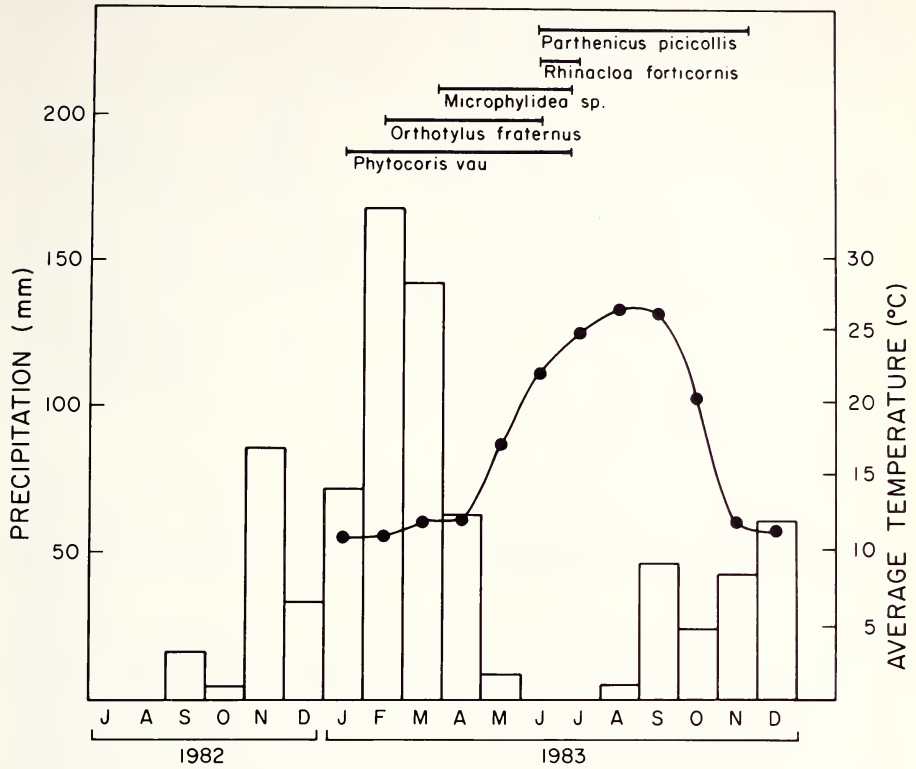

Fig. 7. Seasonal distribution of Miridae at Site I (Menifee Valley, CA) relative to monthly precipitation (bars) and average monthly temperature (connected dots) during the last half of 1982, and 1983.

Phytocoris vau, the first species to appear, occurred in low numbers but had the broadest seasonal range (mid-January–early July). Early instar larvae were collected in January, and adults were not taken until early April (Fig. 6). Only early instars (1–3) were present in January and February; fifth instars did not appear until late March. This suggests slow larval development and perhaps high levels of larval mortality during the winter.

Orthotylus fraternus (Fig. 3) was the second species collected; it occurred for approximately four months (February–June). That larvae were much more common than adults (Fig. 6) suggests high larval mortality (see below). This species was most abundant immediately before flowering of its host (Fig. 5).

Microphylidea sp. (Figs. 1, 2), the third species, was abundant both as larvae and adults. It was the most common species during peak bloom of *A. fasciculatum.* Larvae were first collected a month after the appearance of *O. fraternus,* and adults were active almost a month after the latter had waned. This asynchrony notwithstanding, the activity period of larvae and adults of both species overlapped broadly. The

Table 1. Comparison of seasonal distribution during 1983 of Miridae on *Adenostoma fasciculatum* at Menifee Valley (Site I) and near Mtn Center, CA (Site II).

Species	Site I		Site II	
	1st appearance of larvae	1st/last appearance of adults	1st appearance of larvae	1st/last appearance of adults
Phytocoris vau	Jan 16	Apr 10/Jul 14	May 19	Aug 18[2]
Orthotylus fraternus	Feb 20	Apr 26/Jun 14	Apr 19	May 19/Jun 30
Microphylidea sp. (dark form)	Mar 27	May 4/Jun 22	May 19	Jun 24/Jun 30
Microphylidea sp. (light form)	?[1]	May 22/Jul 6	?[1]	Jun 24/Jul 18
Parthenicus picicollis	Jun 14	Jul 18/Oct 31	May 3	Jun 22/Nov 22[3]
Rhinacloa forticornis	Jun 22	Jun 22/July 6	Jun 24	Jun 30/Sept 12

[1] Not distinguished from dark form larvae.
[2] Only a single female collected.
[3] One adult also collected in January.

disappearance of *Microphylidea* sp. coincided with the end of blooming. The dark form of this species was much less abundant and occurred somewhat earlier than the light form (Fig. 6).

Rhinacloa forticornis occurred in low numbers on *A. fasciculatum.* Adults and larvae were collected on three sampling dates in late June and early July, coinciding with the second half of the flowering period. As with *Microphylidea* sp., it disappeared at the end of flowering (Fig. 5). Considering that *R. forticornis* is known from numerous plants and that adults were not preceded by larvae (Fig. 6), we assume the species moved to chamise from other host(s), produced a single generation, and then migrated to other plants when flowering ceased.

Parthenicus picicollis was the only mirid on *A. fasciculatum* after flowering (Fig. 5). It occurs during the hottest and driest months (Fig. 7) when host growth has slowed or ceased entirely. Its period of activity was almost as broad as that of *Phytocoris vau,* occurring in relatively low numbers from mid-June to the end of November. Only late instar larvae and adults were collected in July. All stages of larvae and adults were taken on almost all sampling dates from August to mid-November (Fig. 6). This strongly suggests more than a single generation.

Collections on *A. fasciculatum* at Site II were similar. The same species occurred, and their sequence of occurrence and relative abundance were similar. As expected due to higher elevation, the earlier species were delayed at Site II (Table 1); the two summer species were not. *Rhinacloa forticornis* was collected at about the same time at both sites, and *P. picicollis* actually was taken first at Site II. *Phytocoris vau* was uncommon at Site II, known only from two larvae and one adult.

Adenostoma sparsifolium Associates

Only two species of Miridae were collected on *A. sparsifolium, Rhinacloa forticornis* and *Phytocoris adenostomae* Stonedahl. The latter, recently described species (Stonedahl, 1985) is known only from red shank.

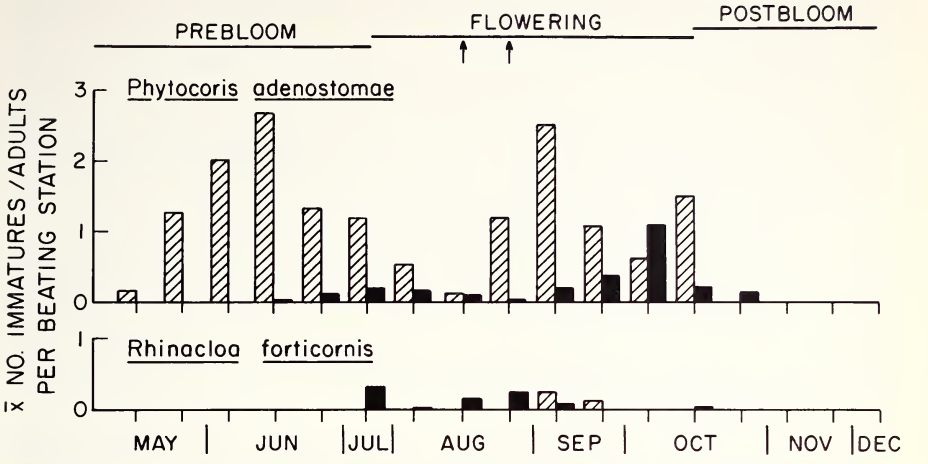

Fig. 8. Phenology and relative abundance of Miridae on *Adenostoma sparsifolium* at Site II (nr Mountain Center, CA) during 1983. Phenology of host plant indicated at top; arrows delimit period of maximum flowering. Bars with diagonal markings = immatures; solid bars = adults. x̄ No. per beating station calculated by dividing total catch by 30 (10 plants, 3 stations per plant).

Phytocoris adenostomae was abundant and active for about six months (mid-May–late November, Fig. 8). The seasonal bimodality of larval abundance and the presence of first and second instars as late as September suggest at least two generations. The activity period of this species straddled the flowering period of its host. It appeared almost two months before blooming began and waned in fall about one month after blooming ceased.

Rhinacloa forticornis adults and larvae were taken in small numbers on *A. sparsifolium.* All were collected during flowering (Fig. 8).

Feeding

All species except *R. forticornis* were observed feeding in the laboratory. *Phytocoris vau* (larvae and adults), *Orthotylus fraternus* (larvae), and *Microphylidea* sp. (larvae and adults) commonly fed on unopened flower buds and stems within the panicled inflorescences. Feeding on leaves was not observed. Adults and at least one larva of *Parthenicus picicollis* fed along the mid-vein of the linear leaves of *A. fasciculatum.* Flowers were not available to this species except at the beginning of its activity period. *Phytocoris adenostomae* fed at the tips of young stems and along the mid-vein of leaves of red shank. One adult also was observed feeding on a conspecific. It is unknown if this individual was killed or already dead when feeding began.

DISCUSSION

One interesting aspect of this study is the demonstration that the two *Adenostoma* harbor distinct species of Miridae. The presence of the widespread *Rhinacloa forticornis* on both is the only exception. Since the *Adenostoma* species are intermixed

at Site II the lack of substantive faunal overlap is attributable to host specificity rather than geographic or habitat differences.

Important differences between the two hosts are their periods of seasonal growth and reproduction. According to Hanes (1965) growth in *A. fasciculatum* is initiated in January and decreases greatly in June. April and May are months of maximum growth. Flowering usually occurs from April to June. *Adenostoma sparsifolium* grows prolifically in May and June and continues at a relatively high level until late autumn. Flowering occurs primarily in August and September.

Mirid activity correlates well with host phenology. Four of the five species on *A. fasciculatum* occur during its growing season. *Parthenicus picicollis* is the only species active when the plant is quiescent. The two most abundant mirid species, *Orthotylus fraternus* and *Microphylidea* sp., occur immediately before and during flowering. Similarly, *Phytocoris adenostomae* occurs on *A. sparsifolium* from May to November, later than most of the mirids on chamise, but during the primary period of growth and reproduction of its host.

The occurrence of *Rhinacloa forticornis* on both species at Site II also correlates with host phenology. It occurs primarily in June on *A. fasciculatum* and from late July to October on *A. sparsifolium.* The occurrence of single adults on chamise in August and September (Table 1) probably represents strays from neighboring *A. sparsifolium.*

The absence of faunal overlap cannot be attributed solely to asynchrony of host growth and flowering because the two *Adenostoma* grow considerably in spring when mirids are active on both. For example, adults and larvae of *P. adenostomae* occur on *A. sparsifolium* in May and June when *A. fasciculatum* is still in bloom. Their absence from adjacent chamise indicates that it is unacceptable as a host.

Much of the data reported here on relative abundance and, perhaps, on breadth of seasonal range should be considered within the context of prevailing climatic conditions. For example, collections of *Orthotylus fraternus,* an early species, showed marked differences in seasonal distribution and abundance in 1983 and 1985. In 1983 larvae were present for more than two months before adults were taken in late April (Fig. 6). Also, mortality apparently was high between the larval and adult stage. In 1985, however, adults were first collected in early March, a month and a half earlier. They also were much more numerous (as many as 8.0 individuals per beating station in 1985, compared to a maximum of 0.5 in 1983).

Climatic conditions were dramatically different during the early months of these two years. Early 1983 was cool and wet with rainfall for February, March and April at Site I 127, 203, and 70 mm, respectively. Average precipitation for these months for locales near Site I are ca. 60, 50, and 25 mm, respectively. By contrast, 1985 was much warmer and quite dry. Only 31 mm of rain fell from February–May, considerably less than average. Since host phenology also differed during these two years the climatic effect on *O. fraternus* may be indirect. In any event, although abundance and seasonal distribution varied in this species, its sequence of appearance relative to others did not.

ACKNOWLEDGMENTS

The authors wish to thank the following for assistance in this study: Thomas Henry, Systematic Entomology Laboratory, USDA, for identification of Miridae; Andrew Sanders, U.C. Riverside

Herbarium, for plant identifications; and Max Badgley and Patricia Mote for preparation of Figures 1–4 and 5–8, respectively.

LITERATURE CITED

Hanes, T. L. 1965. Ecological studies on two closely related chaparral shrubs in southern California. Ecol. Monogr. 35:213–235.

Hanes, T. L. 1977. California chaparral. Pages 417–469 *in:* M. G. Barbour and J. Major (eds.), Terrestrial Vegetation of California. J. Wiley & Sons, New York, 1002 pp.

Knight, H. H. 1968. Taxonomic review: Miridae of the Nevada Test Site and the western United States. Brigham Young Univ. Sci. Bull., Biol. Ser. 9(3):1–282.

Marion, L. H. 1943. The distribution of *Adenostoma sparsifolium.* Am. Midl. Nat. 29:106–116.

Pinto, J. D. 1982. The phenology of the plant bugs (Hemiptera: Miridae) associated with *Ceanothus crassifolius* in a chaparral community of southern California. Proc. Entomol. Soc. Wash. 84:102–110.

Stonedahl, G. M. 1985. *Phytocoris adenostomae,* a new mirine plant bug (Heteroptera: Miridae) from southern California. J. N.Y. Entomol. Soc. 93:1271–1274.

Van Duzee, E. P. 1916. New or little known genera and species of Orthotylini (Hemiptera). Univ. Calif. Publ. Entomol. 1:217–227.

Received September 17, 1985; accepted November 15, 1985.